A Stochastic Approach for Optimal Sequencing of Appraisal Wells

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The life of a hydrocarbon field can be distinguished by five main stages: exploration, appraisal, development, production, and abandonment. Of particular interest is the appraisal stage, where the use of seismic data in combination with appraisal wells permits the estimation of the initial hydrocarbons in place and the quantification of the associated uncertainties. Because of both the high prices of appraisal-well drilling and the opportunity of maximizing uncertainty reduction during the appraisal stage, optimizing on this stage makes it the biggest setting for maximizing project profitability. Nonetheless, with billions of dollars spent on appraisal activities, limited resources are spent on assessing the value of the gathered information.

This paper presents a comprehensive approach to determine the number of appraisal wells, their sequence of drilling, and their justification that is based on economic merit. The presented framework is based on sequentially coupling the uncertainty reduction method with value-of-information (VoI) techniques. Although the uncertainty-reduction method allows ranking locations of appraisal wells on the basis of the maximum uncertainty reduction that they can provide, the VoI analysis provides the difference between the value of developing the project with/without appraisal. The efficiency of the presented sequential appraisal well-location framework will be assessed by applying it on the Stratton gas-field data set.